

Listing of Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A monitoring system comprising:
an implantable medical device configured to be implanted in a patient to provide a stimulus to the patient; and
a monitor separate from the implantable medical device and having a plurality of ECG leads, the monitor having processing circuitry configured to detect a radio frequency artifact from the stimulus of the implantable medical device in order to eliminate an occurrence of falsely identifying voltage artifacts from one or more of the ECG leads as a heart beat.
2. (Original) The monitoring system of claim 1 wherein the processing circuitry is configured to exclude the artifact from heart rate determinations.
3. (Original) The monitoring system of claim 1 wherein the implantable medical device is a pacemaker.
4. (Original) The monitoring system of claim 3 wherein the monitor detects radio frequency by radio telemetry from a remote location relative to the patient.
5. (Original) The monitoring system of claim 1 wherein the monitor is externally attachable to a patient.
6. (Original) The monitoring system of claim 1 wherein the monitor is configured to receive telemetry pacemaker electrograms recorded directly from the heart.

7. (Original) The monitoring system of claim 1 wherein the monitor comprises an antenna to detect the radio frequency artifact.
8. (Original) The monitoring system of claim 7 wherein the antenna is integrated into an ECG electrode.
9. (Original) The monitoring system of claim 1 wherein the processing circuitry comprises a slew limit circuit to limit pace artifact energy in the signals.
10. (Original) The monitoring system of claim 9 wherein the processing circuitry is configured to monitor multiple channels of the signals.
11. (Original) The monitoring system of claim 10 wherein the processing circuitry comprises a tunable band pass filter to isolate the voltage artifact from ambient noise.
12. (Original) The monitoring system of claim 11 wherein the tunable band pass filter may be configured according to variations in gain, center frequency and band width.
13. (Original) The monitoring system of claim 12 wherein the tunable band pass filter is configured automatically.
14. (Original) The monitoring system of claim 12 wherein the tunable band pass filter is configured manually by a user.
15. (Original) The monitoring system of claim 9 wherein the processing circuitry is configured to automatically select from alternative sets of quasi orthogonal ECG leads in the event of different patient cable attachments or electrode failures.

16. (Original) The monitoring system of claim 15 wherein selection is accomplished by a multiplexor hardware circuit.

17. (Original) The monitoring system of claim 15 wherein selection is accomplished by software when all channels have been digitized.

18. (Currently amended) A monitoring system for use in monitoring a patient having an implantable medical device comprising:

a monitor positionable external to the patient and configured to detect a radio frequency artifact resulting from a stimulus generated by the ~~from the signals of an~~ implantable medical device; and

processing circuitry configured to process the radio frequency artifact created by the stimulus ~~from signals of the~~ implantable medical device in order to determine where the radio frequency artifact occurs in an ECG and identify heart beats that are paced and heart beats that are not paced and occurrences of pacing that fail to stimulate a heart beat.

19. (Original) The monitoring system of claim 18 wherein the processing circuitry is configured to exclude artifact from heart rate determinations.

20. (Original) The monitoring system of claim 19 wherein the processing circuitry is configured to classify pacing stimuli according to heart chamber location.

21. (Original) The monitoring system of claim 20 wherein the processing circuitry comprises a slew limit circuit to limit pace artifact energy in the signals.

22. (Original) The monitoring system of claim 20 wherein the processing circuitry is configured to monitor multiple channels of the signals.

23. (Original) The monitoring system of claim 20 wherein the processing circuitry comprises a tunable band pass filter to isolate the voltage artifact from ambient noise.

24. (Cancelled)

25. (Currently amended) A circuit for processing voltage artifacts created by a stimulus generated by an ~~from implantable pacemaker signals comprising:~~

a slew limit circuit to limit pace artifact energy in sensed voltage signals from a patient~~the signals~~; and

a tunable band pass filter operable in parallel to the slew limit circuit and configured to isolate the voltage artifact from ambient noise and heart signals in the voltage signals.

26. (Currently amended) The circuit of claim 25 wherein the circuit is configured to monitor multiple channels of the voltage signals.

27. (Original) The circuit of claim 25 wherein the tunable band pass filter may be configured according to variations of gain, center frequency and band width.

28. (Original) The circuit of claim 27 wherein the tunable band pass filter is configured automatically.

29. (Original) The circuit of claim 27 wherein the tunable band pass filter is configured manually by a user.

30. (Original) The circuit of claim 25 further comprising a timing circuit that measures the duration of pulses.

31. (Original) The circuit of claim 25 wherein a data channel is sampled at a rate in the range of about 18,000 to about 150,000 samples per second and pace detection is principally a digital processing algorithm.

32. (Original) The circuit of claim 25 wherein pace channel data is amplified by a linear or piece wise linear or logarithmic function and peak stretched and converted from analog to digital.

33. (Currently amended) The circuit of claim 25 wherein the circuit is configured to process radio frequency artifact created by the generation of the stimulus by ~~from signals of the implantable pacemaker device~~ in order to identify where pacing stimulus artifact occurs in an ECG and determine which heart beats are paced and which heart beats are not paced and occurrences of pacing that fail to stimulate a heart beat.

34. (Original) The circuit of claim 33 wherein the circuit is configured to exclude pacing stimulus artifact from heart rate determinations.

35. (Original) The circuit of claim 34 wherein the circuit is configured to classify pacing stimuli according to heart chamber location.

Claims 36 – 41 (Cancelled)

42. (Currently amended) A system for monitoring signals from an implantable medical device positioned within a patient comprising:

means positioned external to the patient for detecting a radio frequency artifact created by ~~from~~ the implantable medical device upon generation of a stimulus to the patient; and

means for processing the detected radio frequency artifact from the implantable medical device in order to determine where the radio frequency artifact occurs in an ECG and identify heart beats that are paced and heart beats that are not paced and the generation of stimuli ~~occurrences of pacing~~ that fail to stimulate a heart beat;
wherein the voltage artifact is excluded from heart rate determinations.

43. (Original) The system of claim 42 further comprising a means for detecting the radio frequency artifact by radio telemetry from a remote location relative to a patient.

44. (Original) The system of claim 42 further comprising a means of monitoring multiple channels of the signals.

Claims 45 – 58 (Cancelled)